## PLENARY LECTURE: HIGHEST SCORING 2ND ESTRO FORUM ABSTRACTS

**OC-0499**

**HNSCC cell lines positive for HPV and p16 possess high cellular radiosensitivity due to impaired DSB repair capacity**

T. Rieckmann[1], M. Kriegs[1], C.J. Busch[2], S. Tribius[3], C. Petersen[3], E. Dikomey[1]
[1]*University Medical Center Hamburg - Eppendorf (UKE), Laboratory for Radiobiology and Experimental Radiation Oncology, Hamburg, Germany*
[2]*University Medical Center Hamburg - Eppendorf (UKE), Department of Otorhinolaryngology and Head and Neck Surgery, Hamburg, Germany*
[3]*University Medical Center Hamburg - Eppendorf (UKE), Department of Radiation Oncology, Hamburg, Germany*

**Purpose/Objective:** When treated by radiotherapy, patients with squamous cell carcinomas of the head and neck (HNSCC) positive for HPV and p16 possess a clearly favorable prognosis as compared to those with HPV-negative HNSCC when the therapeutic regimens applied include radiotherapy. It was the aim of this work to study whether this phenomenon may be caused by an enhanced cellular radiosensitivity.
**Materials and Methods:** The radiation response of five HPV and p16 positive cell lines was compared to the response of five HPV and p16 negative HNSCC strains. Cells were characterized with regard to cellular radiosensitivity, G1- and G2-arrest, apoptosis and residual DNA double strand breaks (DSB). Methods comprised the colony formation assay, the detection of PARP cleavage, the fluorescence-based detection of caspase activity, propidium iodide staining, the colcemid-based G1-efflux assay and the immunofluorescence staining of gH2AX and 53BP1 foci.
**Results:** On average, the cellular radiosensitivity of the five HNSCC cell lines positive for HPV and p16 was clearly enhanced when compared to the sensitivity of the HPV negative cells (SF3= 0.2827 vs. 0.4455). This increase does not result from an increase in apoptosis or the execution of a permanent G1-arrest, but is rather associated with both, elevated levels of residual DSBs and extensive G2-arrest.
**Conclusions:** Increased cellular radiosensitivity due to compromised DNA repair capacity is likely to contribute to the improved outcome of patients with HPV/p16 positive tumors when treated by radiotherapy.

**OC-0500**

**A national dosimetric audit of VMAT and Tomotherapy in the UK**

C.H. Clark[1], M. Hussein[1], Y. Tsang[2], D. Wilkinson[2], R.A.S. Thomas[3], J.A.D. Snaith[3], C. Gouldstone[3], G. Bass[3], S. Bolton[4], A. Nisbet[1]
[1]*St. Luke's Cancer Centre Royal Surrey County Hospital, Medical Physics, Guildford, United Kingdom*
[2]*Mount Vernon Hospital, Medical Physics, London, United Kingdom*
[3]*National Physical Laboratory, Dosimetry, London, United Kingdom*
[4]*The Christie Hospital, Medical Physics, Manchester, United Kingdom*

**Purpose/Objective:** Following a successful national audit of static-beam IMRT [1], a survey of 62 UK cancer centres in July 2010 indicated that around 30% were treating with some form of rotational radiotherapy (RRT) (Varian RapidArc, Elekta VMAT or Helical Tomotherapy), and that this would increase to 50% by the end of 2011. This rapid uptake led to the need for a national audit for RRT. We have previously investigated the use of a commercial detector array for national audit and developed a methodology for planning and measurement [2].
**Materials and Methods:** 30 UK cancer centres, who had already begun treating with RRT, took part in the audit and were visited between June 2011 - November 2012. This included 20 x Varian (17 Eclipse, 2 OMP, 1 Pinnacle), 6 x Elekta (4 Monaco, 1 OMP, 1 Pinnacle), and 4 x Helical Tomotherapy. The UK IMRT credentialing program which covers RRT deliveries as well as static gantry IMRT delivery was used. This included a virtual phantom with 5 pre-created PTVs and one OAR, named the 3DTPS test [3], which all centres completed. Each centre also chose a clinical trial planning exercise (head and neck, pelvis or breast). Every centre was visited to make measurements on both plans using a PTW Octavius II phantom with the PTW seven29 2D Array. All verification plans were created on CT scans of the Octavius phantom with evaluations made using Verisoft. Global gamma index (γ) calculations were made using a 20% threshold, relative to a point in a high dose low gradient, and using absolute dose. Dose point differences were also calculated in regions corresponding to PTVs and OARs.
**Results:** A total of 155 dose planes were measured and 283 point dose differences were calculated. For the 3DTPS test the percentage of planes achieving at least 95% of γ<1 were 45.7% (2%/2mm); 71.4% (3%/2mm); 88.6% (3%/3mm) and 100% (4%/4mm). The mean (sd) γ pass rates were: 93.2% (7.7%); 97.0% (4.7%); 98.7% (2.5%); 99.8% (0.7%) respectively. For the clinical plans the percentage of planes achieving at least 95% γ<1 were 62.5% (2%/2mm); 82.8% (3%/2mm); 95.3% (3%/3mm) and 100% (4%/4mm). The mean (sd) γ pass rates were: 93.6% (6.8%); 97.5% (3.9%); 99.2% (1.5%); 99.9% (0.3%) respectively.
Point dose differences for the 3DTPS test gave a mean of 0.2% (2.7%) for all points and a mean of 0.3% (2.0%) for PTVs only. For the clinical plans the mean difference was -0.4% (2.1%) and -0.3% (1.7%) for all points and PTV points respectively. The range of dose differences is shown in figure 1.

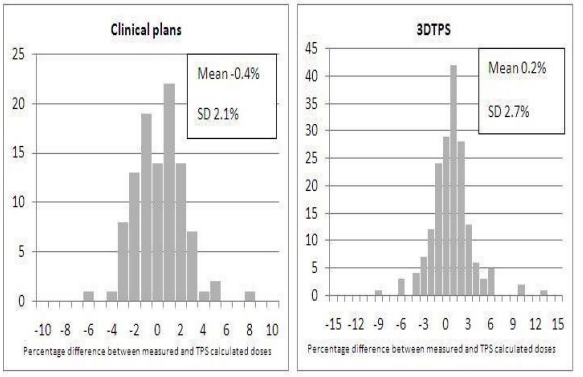


Figure 1: Histograms of a) all clinical dose points & b) all 3DTPS plan points showing frequency of % difference between measured and TPS calculated dose points.

**Conclusions:** A national audit of rotational radiotherapy has been undertaken in the UK. This has shown that more than 93% of analysed planes gave greater than 95% pass rates for gamma parameters of 3%/3mm, thus achieving accurate implementation for TPS modelling and delivery for VMAT and Tomotherapy.
References
[1] Budgell et al R&O 2011;99:246-252.
[2] Hussein et al R&O 2012;103(1):S25-S26
[3] Tsang et al BJR in press

## AWARD LECTURE: BREUR AWARD LECTURE

**SP-0501**

**This is not an apple ...**

V. Grégoire[1]
[1]*Université Catholique de Louvain, Cliniques Univ. St.Luc, Radiation Oncology and Molecular Imaging Radiothera*

Radiation treatment comprises all the necessary steps from tumor diagnosis, multidisciplinary treatment decision, selection and delineation of tumor volumes (TV) and organs at risk (OAR), evaluation of dose distribution, and patient follow-up during and after completion of treatment. At each of these steps, the radiation oncologist has to manipulate images from various origins (e.g. CT-scan, MRI, PET) and extract as much information as possible on the tumor extent, its biological profile, its response to therapy, not to mention that at the end of the day he will have to use his expertise to delineate TVs and OARs.
But what is the biological meaning of an image and how reliable is it to depict the true tumor extent? Should images be used not only before but also during treatment to monitor tumor and normal tissue changes and allow for treatment individualization? What are the requirements to get meaningful images, how should one automatically extract information from various imaging modalities, and which processes should one put in place to streamline their use?
All of these issues will be discussed during this Breur lecture, using head and heck tumors as a paradigm to try to illustrate that in 2013 and beyond radiation oncology should be conformal, tailored and adaptive.